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THE WINTER OF 1982-83 IN OHIO[1]

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ABSTRACT. The winter of 1982-83 in Ohio was quite unusual. December was extremely mild and rainy with several Ohio weather stations recording December and winter records for maximum temperatures. Temperatures remained above normal during January and February throughout Ohio while precipitation was below normal. Ohio experienced one of its mildest winters of the 20th century. The immediate cause of this mildness was a persistent flow of the jet stream from the west or southwest for much of the winter. The ultimate generator of the unusual weather was probably abnormally warm surface waters in the equatorial Pacific Ocean, commonly referred to as El Niño.

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INTRODUCTION

Ohio's climate is classified as a humid-continental type (Noble and Korsok 1975). Winters in this climate are cold with an average of about five days when temperatures average below −18°C. Indeed, the coldest temperature recorded in Ohio is −39.4°C (Goddard 1979). Winter in Ohio is also snowy. Ohio weather stations receive varying amounts of snowfall with most stations receiving less than 1000 mm although extreme northeastern Ohio receives up to 2500 mm due to lake-effect snows. Whether or not Ohio experiences severe storms, cold temperatures, and excessive snowfalls is largely due to the position of the jet stream, a narrow band of wind with velocities from 160 to 320 km/h and located at altitudes of about 9-12 km. The jet stream determines

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whether warm, tropical air keeps Ohio's temperatures mild or whether cold, polar air invades Ohio. A shift in the jet stream's direction can mean the difference between a blizzard or light flurries (Goddard 1979).

Ohio's winter during 1982-83 was quite mild and was characterized by a lack of severe storms. December was very warm, and several weather stations recorded record maximum temperatures not only for December but also winter maximums as well. All Ohio weather stations recorded above average precipitation with most stations receiving 25-40 mm above normal. Most of the December precipitation fell as rain since temperatures were generally too mild for much snow to fall. Temperatures remained above average in January and February, but precipitation was 25-50 mm below normal for both months. The winter of 1982-83 was not the mildest winter on record, but it was one of the mildest in recent years.

METHODS AND MATERIALS

There are 107 primary weather stations in Ohio which record temperature and precipitation. These stations are fairly evenly distributed geographically and are located in each type of environment occurring in Ohio. Temperature and precipitation data are published monthly in *Climatological Data, Ohio* (1982a, 1983a) by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center. Temperature and precipitation data for December, January, and February were analyzed to reveal monthly and seasonal patterns as well as deviations from the mean. *Daily Weather Maps* (1982b, 1983b), also published by NOAA, provided daily weather patterns and upper air flow. These sources enabled an analysis of Ohio's winter during 1982-83 to be made.

RESULTS AND DISCUSSION

For much of December a high pressure ridge was located over the eastern third of the United States which shunted cyclonic storms north of Ohio and permitted a steady stream of tropical air to flow northward (Ludlum 1983a). In early December a high pressure system was located over the southeastern states. This system pumped warm air into Ohio resulting in temperatures above 20°C. Many December and winter maximum temperature records were set. Cleveland recorded 25°C on 3 December, breaking the old record of 18.3°C set in 1873. Youngstown recorded 24.4°C breaking a 20-yr record of 16.1°C. Columbus set a record with 22.2°C, and Akron-Canton had a new record of 24.4°C. Chillicothe, Gallipolis, Ironton, and Athens all recorded 26.6°C, just shy of the Ohio winter maximum of 27.2°C recorded at Ironton on 25 January 1932.

The highest temperature recorded in Ohio in December was the previously mentioned 26.6°C at Chillicothe, Gallipolis, Ironton and Athens. The lowest was −18.9°C at Millport on 13 December 1982. Hamilton-Fairfield had the highest average temperature, 6.9°C, and Montpelier had the lowest average, 2.3°C.

The 107 primary weather stations in Ohio were on the average 4.98°C warmer than normal in December. Youngstown had the highest departure, +6.4°C. A total of 26 stations had a departure of from 5 to 5.5°C and 19 had a departure of 4.5 to 5°C. The average temperature and departure from normal for each region of Ohio are presented in table 1. The South Central region had the highest average temperature, 6°C, while the Northeast region had the largest departure from normal, +5.2°C. The Northwest region, away from the moderating influence of Lake Erie, had the coldest average temperature, 3.3°C, while the South Central region had the least departure from normal, +4.3°C.

While December was warm, it was also wet. Most Ohio weather stations recorded greater than normal amounts of precipitation. Enterprise recorded the largest amount of precipitation, 166 mm, and Stryker the least, 47 mm. The greatest one-day total precipitation, 42 mm, fell 16 December at Piketon, and the greatest total snowfall, 445 mm, was recorded at Chardon.

On a statewide basis Ohio received 32 mm of precipitation above normal. Precipitation and departure from normal for Ohio's regions are presented in table 2. The Southeast region received the largest amount of precipitation, 109 mm, and

TABLE 1

Average temperature and departure from normal by region.

Region*	DEC temp. °C	DEC depart. °C	JAN temp. °C	JAN depart. °C	FEB temp. °C	FEB depart. °C
Northwest	3.3	+4.8	−2.2	+2.2	0.0	+2.9
North Central	3.9	+4.9	−2.1	+1.7	0.1	+2.6
Northeast	4.2	+5.2	−1.6	+2.2	0.2	+3.0
West Central	3.9	+4.9	−2.2	+1.7	0.6	+2.8
Central	4.7	+5.1	−1.2	+1.6	1.2	+2.3
Central Hills	3.7	+5.0	−2.1	+1.9	0.1	+2.7
Northeast Hills	4.2	+4.9	−1.3	+1.7	0.4	+2.2
Southwest	5.4	+4.8	−0.8	+0.9	1.7	+1.7
South Central	6.0	+4.3	−0.1	+0.6	2.1	+1.1
Southeast	4.7	+4.7	−0.9	+1.3	0.8	+1.7

*Standard regions for Ohio developed and used by NOAA

TABLE 2

Average precipitation and departure from normal by region.

Region*	DEC precip. mm	DEC depart. mm	JAN precip. mm	JAN depart. mm	FEB precip. mm	FEB depart. mm
Northwest	82	+26	19	−34	17	−29
North Central	83	+28	22	−36	16	−29
Northeast	93	+30	34	−31	26	−27
West Central	77	+17	26	−39	17	−36
Central	98	+37	31	−35	21	−33
Central Hills	98	+38	32	−33	31	−20
Northeast Hills	75	+13	27	−43	39	−19
Southwest	106	+37	45	−35	21	−45
South Central	100	+28	36	−42	37	−31
Southeast	109	+44	30	−42	44	−19

*Standard regions for Ohio developed and used by NOAA

also had the largest departure from normal, +44 mm. The Northeast Hills region averaged the least amount of precipitation, 75 mm, and also had the least departure from normal, +13 mm.

Temperatures continued to be above normal in January but the statewide average departure from normal, +3.3°C, was only a third of December's departure from normal. Milford recorded the highest temperature in January, 19.4°C, on the 29th, and Dorset recorded January's lowest temperature, −27.2°C on the 20th. Gallipolis had the highest average, 0.8°C, and Montpelier's average of −3.3°C was the state's lowest. The South Central region had January's highest average, 0.06°C, while the Northeast region had the highest departure from normal, +2.2°C (table 1). Wauseon had the highest departure from normal, +3.4°C, and Portsmouth had the only negative departure from normal, −0.2°C.

While December was abnormally wet, January was drier than normal. Statewide, the average departure from normal was −35 mm. The Northeast region, which includes the snowbelt, averaged 34 mm

while the Northeast Hills had the highest departure from normal, −43 mm (table 2). Marietta received the greatest amount of precipitation, 74 mm, and Mansfield the least, 12 mm. The greatest one-day precipitation occurred at Hillsboro on 22 January when 39 mm was recorded. Chardon and Dorset were the snowiest locations in January, each receiving 457 mm.

February continued warm. On a statewide basis Ohio temperatures averaged 2.6°C warmer than the mean. The highest temperature recorded in February was 22.2°C at Waverly on 21 February, and the coldest was −20.6°C at Dorset on 12 February. Peebles had Ohio's warmest average, 2.8°C, and Canfield recorded the coldest average, −1.5°C. Regionally, the South Central region had the warmest average, 2.1°C, and the Northeast region had the highest departure from normal, +3°C (table 1). Youngstown once again had the largest departure from normal, +4.1°C, and Gallipolis had the least departure from normal, +0.83°C. Forty-eight stations recorded departures from normal from two to three degrees.

February continued to be drier than normal. The state as a whole averaged 29 mm below normal precipitation. The Southwest region had the greatest precipitation, 45 mm (table 2). Marietta received the greatest amount of precipitation, 75 mm, and Huntsville the least, 10 mm. The greatest one-day precipitation was 32 mm on 3 January at Hannibal Lock and Dam, and the greatest monthly snowfall was at McArthur which received 312 mm.

Precipitation for the three-month winter season was below normal despite December's excesses. The state as a whole was 34 mm below normal. Snowfall totals for the three-month period ranged from 76 mm at Cincinnati and Eaton in southwestern Ohio, to 1189 mm at Chardon in the lake-effect snowbelt in northeastern Ohio. Northwestern Ohio had a total snowfall of 100-150 mm, central Ohio from 130 to 250 mm, the central hills from 250 to 365 mm, southeastern Ohio from 150 to 460 mm, and the northeastern hills from 350 to 530 mm. The snowbelt of northeastern Ohio received the largest amount of snow, ranging from 406 mm at Painesville to 1189 mm at Chardon.

The 1982-83 winter season was remarkedly devoid of severe weather. Only two storms were severe enough to be reported in *Storm Data.* On 28 December a cold front passed through the state. Strong southerly winds ahead of the front gusted to 113 km/h. Frequent gusts in excess of 90 km/h were reported in all sections of the state and power outages were common (NOAA 1982c). On 22 January freezing rain fell in west central Ohio. Trees and utility lines were damaged, and roads were coated with ice. Hardest hit were Darke, Greene, Clark, and Champaign counties (NOAA 1983c).

From 10 to 12 February the eastern seabroad from Virginia to Connecticut was hit by one of the worst snowstorms of the century. With blizzard conditions over much of the area, many eastern cities were paralyzed with over 500 mm accumulations (NOAA 1983d). Maximum accumulation from the storm was 889 mm. Southeastern Ohio received from 50 to 230 mm of snow from this storm. This was, in most cases, most of the snowfall received by southeastern stations during the three-month period.

The mild temperatures experienced throughout Ohio during December, January, and February, as well as the lack of storms, largely can be explained by analyzing upper air flow. The subtropical jet stream was located several degrees south of its normal position, flowing across the Gulf of Mexico and Florida (fig. 1). Thus cyclone trajectories in January and February were much further south than normal which accounts for the lack of storms in Ohio during this period. Also, the strong, persistent southwesterly and westerly flow of the subtropical jet across the southern United States is associated with the warming trend experienced not only in Ohio but throughout much of the eastern United

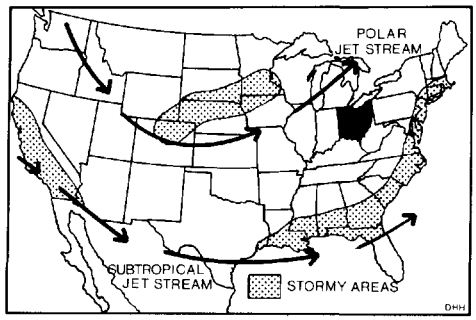

FIGURE 1. Generalized position of the polar and subtropical jet streams, winter, 1982-83.

States as well. In conjunction with the southerly jet stream flow was relatively weak ridging in the western United States. This minimized cold air advection from Canada and kept the polar jet stream north of Ohio for most of the winter (Quiroz 1983).

While Ohio enjoyed a mild winter, other sections of the country experienced severe weather. California reeled from an amazing series of severe Pacific storms; the Great Plains received several large snowstorms; record flooding occurred in the South and in the West, and the East Coast experienced one of the most severe snowstorms to hit the region during this century. These climate anomalies were all associated with the intensification and southward displacement of the subtropical jet stream (Rasmusson and Wallace 1983).

Meteorologists found a demonstrable link between the anomalies occurring in the United States during the winter of 1982-83 and the warming of the eastern equatorial Pacific Ocean. At intervals that vary from two to 10 yr, trade winds in the western and central Pacific relax or reverse which generates an eastward-moving ocean wave, causing the replacement of cold upwelled water with warm surface water (Glantz 1983). The warming of the eastern Pacific Ocean in the equatorial region is commonly referred to as an El Niño event. The 1982-83 El Niño was especially strong and peaked during December, January, and February (Rasmusson and Wallace 1983). While the ocean-atmosphere interactions are complex, basically the elevated ocean temperatures cause enormous amounts of heat and moisture to be added to the atmosphere. This addition of heat and moisture, in turn, affects atmospheric circulation, especially the behavior of the jet stream (Rasmusson and Hall 1983). Thus some regions experience drought while others suffer from increased severe storm activity.

The mild winter of 1982-83 was welcomed by Ohioans who remembered the severe cold and high fuel bills that marked recent winters. Januaries in 1977, 1978, 1979, 1981, and 1982 were especially cold and snowy (Ludlum 1983b). However, the winter of 1982-83 was not the mildest one experienced in Ohio. That distinction goes to the winter of 1931-32 when no temperatures below −18°C were recorded until 9 March when three stations recorded −18.3°C, the lowest temperature of the winter. Another exceptionally mild winter occurred in 1949-50 which produced the mildest January on record. This was when Ironton recorded the highest January temperature of all time, 27.2°C.

The winter of 1982-83 was notable for a lack of severe storms and anomalies in temperature and precipitation patterns. The significance of the winter's unusual weather was that it provided a strong example of how upper air circulation can affect the weather of a given region. The 1982-83 El Niño event, which illustrated tropical-extra-tropical and ocean-atmosphere interaction, was especially strong and caused widespread climate anomalies. While it is easy to oversimplify a very complex system, there was a definite association of the weather patterns in Ohio and the 1982-83 El Niño event.

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